

# Energy Management Modular Universal Utility Meter and Power Analyzer Type WM4-96



- Optional RS 422/485 serial output
- Optional RS232 + real time clock function and 2Mb data logging of alarms, MIN/MAX events and up to 8 variables with programmable time interval.
- MODBUS RTU, JBUS protocol
- Transmission and reception of SMS messages (variables and alarm status)
- Data transmission and reception by means of analogue modem
- Up to 4 optional pulse outputs
- Up to 4 optional alarm outputs
- Universal power supply: 18-60VAC/VDC, 90-260 VAC/VDC
- Front degree protection: IP 65

## Product Description

Universal utility meter and power analyzer which can be used in 3 different operating modes:

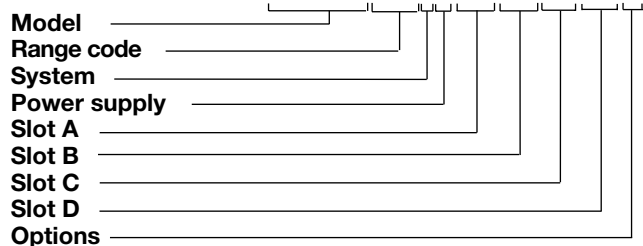
- direct measurements for the power quality analysis (LV or MV/HV connection);
- indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection);
- direct measurements for the instantaneous variables (LV connection) and indirect

measurements for the energy variables (LV or MV/HV). It's possible to add the management of gas and water metering to all of these working modes. Automatic transmission of SMS alarm messages. Remote read-out from GSM mobile phones of all the instantaneous variables, the last variables available in the data logging and the energy meters.

- Class 0.5 (current/voltage)
- Universal meter: energy, water and gas
- 32-bit  $\mu$ P-based multifunction power analyzer
- Back-lighted graph display (128x64 dots)
- Front size: 96x96 mm
- Measurement of single phase and system instantaneous variables: W,  $W_{dmds}$ , var,  $var_{dmds}$ , VA,  $VA_{dmds}$ , PF,  $PF_{avg}$ , V,  $A_{L1}$ ,  $A_{n1}$ , Hz, THD (for all measurements max and min values)
- Measured energies: kWh and kvarh on 4 quadrants
- Graphic display of the load profile (daily, weekly, monthly display)
- Current and voltage inputs with autoranging capability
- 4x4 dgt instantaneous variable read-out
- 4x9 dgt total energies read-out
- 4x6 dgt partial energies read-out
- 48 independent energy meters to be used as single, dual, multi-time energy management
- Interface with watt-hour meters by means of digital inputs (+kWh, +kvarh, -kWh, -kvarh)
- Interface with gas and water meters by means of digital inputs (one water meter, two gas meters to be used as single or dual time management)
- Display refresh rate: 10 samples/s
- Harmonic distortion analysis (FFT) up to the 50th harmonic with graphic and numeric indication (current and voltage)
- Harmonics source detection

## How to order

**WM4-96 AV53H XX XX XX XX X**



## How to order

**Wm4Soft Network  
Wm4Soft Remote**

Wm4Soft Network: program to download memory data and to manage a modem. Wm4Soft Remote: program to set all the programming parameters.

## Type selection

Range code (on request)	Slot A (interfacing)	Slot B (communication)	Slot C (alarm or pulse)
<b>XXX:</b> None	<b>XX:</b> None	<b>XX:</b> None	<b>XX:</b> None
<b>AV5:</b> 240/415 VAC- 1/5 AAC (max. 300 V (L-N)/ 520 V (L-L) - 6 A)	<b>D2:</b> 3 universal digital inputs + excitation output (16-24VDC)	<b>S1:</b> Serial output, RS485 multidrop, bidirectional	<b>R1:</b> Single relay output (AC1-8AAC, 250VAC)
<b>AV7:</b> 400/690VAC - 1/5 AAC (max. 480V (L-N) / 830 V (L-L) / 6 A)			<b>R2:</b> Dual relay output, (AC1-8AAC, 250VAC)
			<b>O1:</b> Single open collector output (30V/100mADC)
			<b>O2:</b> Dual open collector out- put (30V/100mADC)
			<b>D1:</b> 3 digital inputs for volt- age-free contacts
			<b>D2:</b> 3 universal digital inputs + excitation output (16-24VDC)
<b>Power supply</b>	<b>Slot D (alarm or pulse)</b>	<b>Options</b>	
<b>L:</b> 18 to 60VAC/VDC	<b>XX:</b> None	<b>X:</b> None	
<b>H:</b> 90 to 260VAC/VDC	<b>R2:</b> Dual relay output, (AC1-8AAC, 250VAC)	<b>M:</b> Serial port RS232+RTC+ 2Mb or Data memory to store all events and contin- uous record up to 8 variables	
	<b>O2:</b> Dual open collector output (30V/100mADC)		
	<b>O4:</b> Four open collector out- put (30V/100mADC)		

## Input specifications

<b>Number of analogue inputs</b>			
Current	1 (1-phase; system code: 3) 3 (3-phase; system code: 3)		
Voltage	1 (1-phase; system code: 3) 4 (3-phase; system code: 3)		
<b>Digital inputs</b>			
AQ1038	No. of inputs: 3 (voltage-free) $W_{dmd}$ measurement synchronization + $var_{dmd}$ and $PF_{dmd}$ . Interfacing with watt-hour meters (+kWh, +kvarh). Tariff selection: energy. <8mA/ 17.5 to 25VDC		
Purpose			
Contact measuring current			
AQ1042	Number of inputs: 3 + excitation output $W_{dmd}$ measurement synchronization + $var_{dmd}$ and $PF_{dmd}$ . Interfacing with watt-hour meters (-kWh, -kvarh) or/and measurements of gas /water m <sup>3</sup> . Tariff selection: energy or GAS. 16V<+Aux<24VDC Max 15mA 15mA		
Purpose			
Excitation output			
Contact measuring current			
Common characteristics			
Input frequency	Max 20 Hz, dutycycle 50%		
Close contact resistance	Max 1k $\Omega$		
Open contact resistance	Min 100k $\Omega$		
Insulation	4000VRMS		
Max. input number	6 in the configuration: AQ1038+AQ1042 or 2* AQ1042		
<b>Accuracy</b> (display, RS232, RS485)	In: 5A, I <sub>f.s.</sub> : 6A V <sub>n</sub> : 240VL-N, V <sub>f.s.</sub> : 300VL-N $\pm 0.5\%$ RDG (0.2 to 1.2 In) $\pm 5$ mA (0.02 to 0.2 In) $\pm 1\%$ RDG (0.2 to 1.2 In) @ 40 to 100 Hz		
Current (A <sub>L1</sub> , A <sub>L2</sub> , A <sub>L3</sub> ) (@25°C $\pm 5$ °C, R.H. $\leq 60\%$ )			
Current (A <sub>n</sub> )			
Voltage	AV5 range: $\pm 0.5\%$ RDG (48 to 300 V <sub>L-N</sub> ) $\pm 1\%$ RDG (84 to 519 V <sub>L-L</sub> ) AV7 range: $\pm 0.5\%$ RDG (80 to 480 V <sub>L-N</sub> ) $\pm 1\%$ RDG (139 to 830 V <sub>L-L</sub> )		
AV5 range: (@25°C $\pm 5$ °C, R.H. $\leq 60\%$ )			
AV7 range:			
Frequency	Includes also: frequency, power supply and output load influences $\pm 0.1\%$ RDG (40 to 440 Hz)		
Active power (@ 25°C $\pm 5$ °C, R.H. $\leq 60\%$ )	$\pm 0.5\%$ (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, range AV5) or $\pm 1\%$ RDG (PF 0.5 L/C, 0.1 to 1.2 In, range AV5)		
Reactive power (@ 25°C $\pm 5$ °C, R.H. $\leq 60\%$ )	$\pm 0.5\%$ (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, range AV5) or $\pm 1\%$ RDG (PF 0.5 L/C, 0.1 to 1.2 In, range AV5)		
Apparent power (@ 25°C $\pm 5$ °C, R.H. $\leq 60\%$ )	$\pm 0.5\%$ (RDG + FS) (0.1 to 1.2 In, range AV5) or $\pm 1\%$ RDG (0.1 to 1.2 In, range AV5)		
Energies (@ 25°C $\pm 5$ °C, R.H. $\leq 60\%$ )	Active: class 1 according to EN61036 Reactive: class 2 according to EN61268		
		lb: 5A, I <sub>max</sub> : 6A 0.1lb: 500mA, Start-up current: 20mA Un: 240V (AV5), 400V (AV7) 1% FS (FS: 100%) phase: $\pm 2^\circ$ ; I <sub>min</sub> : 0.1Arms; I <sub>max</sub> : 15Ap; U <sub>min</sub> : 50V <sub>RMS</sub> ; U <sub>max</sub> : 500Vp Sampling frequency: 6400 samples/s @ 50Hz	
		<b>Harmonic distortion</b> (@ 25°C $\pm 5$ °C, R.H. $\leq 60\%$ )	
		<b>Additional errors</b>	
		Humidity	$\leq 0.3\%$ RDG, 60% to 90% R.H.
		Input frequency	$\leq 0.4\%$ RDG, 62 to 400 Hz
		Magnetic field	$\leq 0.5\%$ RDG @ 400 A/m
			NOTE: all accuracies are referred to measurements carried out with the analogue input module
		<b>Temperature drift</b>	$\leq 200$ ppm/°C
		<b>Sampling rate</b>	6400 samples/s @ 50Hz
		<b>Display</b>	Graph LCD backlighted (128x64 dots). Read-out for the instantaneous variables: 4x4 digit or 4x3 <sup>1</sup> / <sub>2</sub> digit Total energies: 4x9 digit; Partial energies: 4x6 digit
		<b>Max. and min. indication</b>	Max. 9999 (999,999,999), Min. -9999 (-999,999,999)
		<b>Measurements</b>	Current, voltage, power, energy, power factor, frequen- cy, harmonic distortion (see "Display Pages"). TRMS measurement of a distorted wave (voltage/current) .
		Coupling type	Direct.
		Crest factor	$\leq 3$ , max. 15Ap/500Vp "AV5" (L-N), 15Ap/800Vp "AV7" (L-N)
		<b>Ranges (impedances)</b>	
		AV5	58/100 V (> 500 k $\Omega$ ) - 1 AAC ( $\leq 0.3$ VA) 58/100 V (> 500 k $\Omega$ ) - 5 AAC ( $\leq 0.3$ VA) 240 V/415 V (> 500 k $\Omega$ ) - 1 AAC ( $\leq 0.3$ VA) 240 V/415 V (> 500 k $\Omega$ ) - 5 AAC ( $\leq 0.3$ VA)
		AV7	100/170 V (> 500 k $\Omega$ ) - 1 AAC ( $\leq 0.3$ VA) 100/170 V (> 500 k $\Omega$ ) - 5 AAC ( $\leq 0.3$ VA) 400/690 V (> 500 k $\Omega$ ) - 1 AAC ( $\leq 0.3$ VA) 400/690 V (> 500 k $\Omega$ ) - 5 AAC ( $\leq 0.3$ VA)
		<b>Frequency</b>	40 to 440 Hz
		<b>Overload protection</b>	
		Continuous: voltage/current:	AV5: 300V <sub>L-N</sub> / 500V <sub>L-L</sub> / 6A AV7: 480V <sub>L-N</sub> / 830V <sub>L-L</sub> / 6A
		For 1s: voltage/current:	AV5: 600V <sub>L-N</sub> / 1040V <sub>L-L</sub> / 120A AV7: 960V <sub>L-N</sub> / 1660V <sub>L-L</sub> / 120A

## Output specifications

<b>RS422/RS485 (on request)</b>  Connections  Addresses Protocol Data (bidirectional) Dynamic (reading only)  Static (writing only)  Data format  Baud rate  Insulation	Multidrop bidirectional (static and dynamic variables) 2 or 4 wires, max. distance 1200m, termination directly on the module from 1 to 255, key-pad selectable MODBUS RTU/JBUS  All display variables, see also the table, "List of the connected variables". All configuration parameters energy reset, activation of digital outputs. 1 start bit, 8 data bit, no parity/even parity/odd parity, 1 stop bit 1200, 2400, 4800 and 9600 bit/s selectable By means of optocouplers, 4000 V <sub>RMS</sub> output to measuring inputs 4000 V <sub>RMS</sub> output to power supply input	<b>Pulse outputs (on request)</b> Number of outputs Type  Pulse duration  Insulation  Notes	The outputs are completely programmable independently of the type of module being used.  Up to 4 From 1 to 1000 pulses programmable for k-M-G Wh, k-M-G varh, open collector (NPN transistor) V <sub>ON</sub> 1.2 VDC/ max. 100 mA V <sub>OFF</sub> 30 VDC max. Outputs connectable to total and/or partial energy meters 220 ms (ON), ≥ 220 ms (OFF) According to DIN43864 By means of optocouplers, 4000 V <sub>RMS</sub> output to measuring inputs, 4000 V <sub>RMS</sub> output to power supply input. The outputs can be either open collector type or relay type (for the relay output refer to the specifications described in the "alarm outputs" section).
<b>RS232 (on request)</b>  Connections Data format  Baud rate  Protocol Other features	Bidirectional (static and dynamic variables) 3 wires, max. distance 15m 1 start bit, 8 data bit, no parity, 1 stop bit 2400, 4800, 9600, 38400 bit/s MODBUS RTU (JBUS) As per RS422/485	<b>Alarm outputs (on request)</b> Number of set-points Alarm type  Monitoring of the variable  Set-point adjustment  Hysteresis  On-time delay Relay status	Up to 4, independent Up alarm, down alarm with or without latch, phase asymmetry, phase loss, neutral loss. All the variables listed at the paragraph "List of the connectable variables". 0 to 100% of the electrical scale 0 to 100% of the electrical scale 0 to 255 s Selectable: normally de-energized or normally energized Relay, SPDT AC 1-8A, 250VAC DC 12-5A, 24VDC AC 15-2.5A, 250VAC DC 13-2.5A, 24VDC ≤ 150 ms, filters excluded, FFT excluded, setpoint on-time delay: "0s" 4000 V <sub>RMS</sub> output to measuring input, 4000 V <sub>RMS</sub> output to power supply input.
<b>Communication by modem</b> Analogue modem  GSM Modem  GSM kit type-tested for WM4	For the remote communication of all the data measured and managed by WM4. External communication Modem. Recommended type: US Robotics For the transmission of SMS messages: alarms, instantaneous variables, last available variables of data logging and energy meters. The alarms can also be transmitted automatically, while the variables can be recalled by means of special SMS question codes Siemens kit (external) model "TC35 TERMINAL" included GSM module, antenna and 230V power supply.	Output type  Min. response time  Insulation  Notes	Relay, SPDT AC 1-8A, 250VAC DC 12-5A, 24VDC AC 15-2.5A, 250VAC DC 13-2.5A, 24VDC ≤ 150 ms, filters excluded, FFT excluded, setpoint on-time delay: "0s" 4000 V <sub>RMS</sub> output to measuring input, 4000 V <sub>RMS</sub> output to power supply input.  The outputs can be either relay type or open collector type (for this latter one, see the specifications mentioned in the pulse outputs)
<b>Digital outputs (on request)</b>	To be used as alarms and/or retransmission of the energy, gas, water metering and/or outputs remotely controlled by the serial communication port.		

## Software functions

<b>Password</b>  1st level 2nd level	Numeric code of max 3 digits; 2 protection levels of the programming data Password "0": no protection Password from 1 to 499: all data are protected Note: by entering in the programming mode by means of password, the measurement is inhibited.	Data management type: Memory size Battery life	measurements of approx. 200 ms. FIFO 2 Mbyte 10 years
<b>Operating mode selection</b>	- Direct measurements for the power quality analysis (LV or MV/HV connection); - Indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection); - Direct measurements for the instantaneous variables (LV connection) and indirect measurements for the energy variables (LV or MV/HV). It's possible to add the management of gas and water metering to all of these working modes.	<b>Data logger function</b>  Historical data storing time  Data format	The data are stored at time intervals from 1 to 60 min.; up to 8 instantaneous variables can be selected. See the "Historical data storing time table". Date: day, month time: hours, minutes, seconds, type of stored variable: variable value.
<b>Pulse weight</b>	Water/gas meter inputs: selectable from 1 to 10000 pulses/m <sup>3</sup> , energy from 1 to 10000.00 imp/kWh/kvarh	<b>Load profile</b>  Historical data storing time  Data format	Storage at time intervals of 5-10-15-20-30 min of Wdmd.  30 weeks: with recording interval of 5min. 90 weeks: with storing interval of 15min.  Wdmd variable value, minutes, seconds, day, month.
<b>Transformer ratio</b>	CT up to 30000A (6000) VT up to 600 kV (6000)	<b>Displaying</b>  Energy meters	4 variables per page 1 page that can be layed out by the user 30 fixed pages Up to 12 pages depending on the selected tariff mode. Displaying of the consumed energy up to two months preceding the current one by means of password (depending on the selected tariff mode). 1 page with two displaying modes depending on the selected one: water and gas m <sup>3</sup> or day-time and night gas m <sup>3</sup> .
<b>Filters</b> Filter operating range  Filtering coefficient Filter action	0 to 99.9% of the input electrical scale. 1 to 255 Display, alarms, serial outputs (fundamental variables: V, A, W and their derived ones).	Water and gas meters  Stored events	240 pages. Display of the data by means of password.
<b>Event logging</b>  Type of data  Sampling management	Only with RS232+RTC module+ Data memory Alarms and max./min. (max. 480 events) stored with date (dd:mm:yy) and hour (hh:mm:ss) reference, data logger and load profile Only for data logger and load profile. The sample stored within the selected time interval results from the continuous average of the measured values. The average is calculated (min. sample) with an interval within two following	Data logger  Load profile	Display of the data by means of password with reset function of the relevant memory section. 3 pages, daily, weekly and monthly graphic display. Reset function of the relevant memory section by means of password.
<b>Display language</b>			Selectable: Italian, English, French, German, Spanish

## Wm4Soft software: parameter programming and memory data transfer

<b>Wm4Soft Network</b>	English language software to transfer memory data and write messages to be coupled to the SMS alarms, plus modem communication	Working mode	management. The program runs under Windows /95/98/98SE/2000/NT/XP. Three different working modes can be selected: - management of a local
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## Wm4Soft software: memory data transfer (cont.)

Data Storing	RS485 network; - management of modem communication from a single instrument to PC (data download); - management of modem communication from local networks (RS485 communication) to a common PC (data download). In pre-formatted XLS files (Excel data base). The instantaneous and the energy, gas, water variables are stored into two separated files.	Modem communication	Phone book management (save up to 100 numbers). Each number is associated to a modem that corresponds either to the single instrument or to a network of instruments. Each network can manage up to 10 local instruments.
Data Transfer	Manual or automatic at programmable timings.	<b>Wm4Soft Remote</b>	English language software to program the working parameters of the instrument. The program runs under Windows 95/98/98SE/2000/NT/XP.
		<b>Data access</b>	By means of RS232 serial port to be coupled to a GSM or analogue modem or RS485 port (also multi-drop availability.).

## General Specifications

<b>Operating Temperature</b>	0 to +50°C (32 to 122°F) (R.H. < 90% non-condensing)	<b>Other standards</b>	IEC 61010-1, EN 61010-1
<b>Storage temperature</b>	-10 to +60°C (14 to 140°F) (R.H. < 90% non-condensing)	Safety Product	Energy measurements: EN61036, EN61268.
<b>Insulation reference voltage</b>	300 V <sub>RMS</sub> to ground (AV5 input)	Pulse output	DIN43864
<b>Insulation</b>	4000 V <sub>RMS</sub> between all inputs/outputs to ground	<b>Approvals</b>	CE, UL and CSA
<b>Dielectric strength</b>	4000 V <sub>RMS</sub> for 1 minute	<b>Connector</b>	Screw-type max. 2.5 mm <sup>2</sup> wires (2x 1.5mm <sup>2</sup> )
<b>Noise Rejection CMRR</b>	100 dB, 48 to 62 Hz	<b>Housing</b>	Dimensions Material
<b>EMC</b>	IEC EN 61000-6-2, IEC EN 61000-6-3	96x96x140 mm ABS, self-extinguishing: UL 94 V-0 Front: IP65	<b>Protection degree</b>
		<b>Weight</b>	Approx. 600 g (packing included)

## Load profile display

Installed power

Example: the consumed power integrated in 15 minutes exceeds the installed power

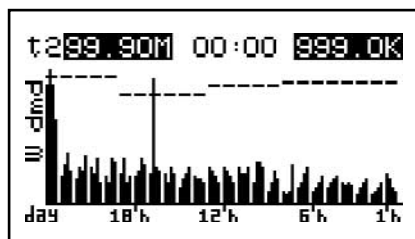
Graph of consumptions

Time of the last integration

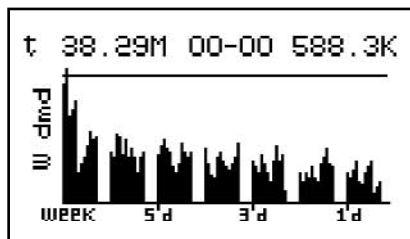
Wdmd of the last integration period

Profile of the installed power divided into time periods

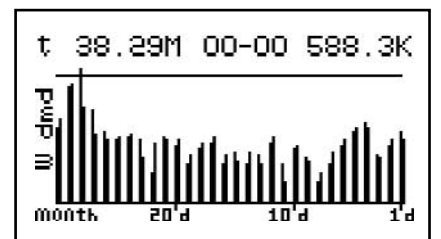
By means of the "F" key you can display the single integration time periods and the details relating to the value of the installed power programmed for that time period, the storing time of the Wdmd sample and the relevant value.



Daily graph: resolution of 15 minutes, total time of 24 hours.



Weekly graph: resolution of 2 hours, total time of 7 days.



Monthly graph: resolution of 12 hours, maximum total time of 31 days.



## Supply specifications

<b>AC/DC voltage</b>	90 to 260V (standard) 18 to 60V (on request)	<b>Power consumption</b>	≤ 30VA/12W (90 to 260V) ≤ 20VA/12W (18 to 60V)
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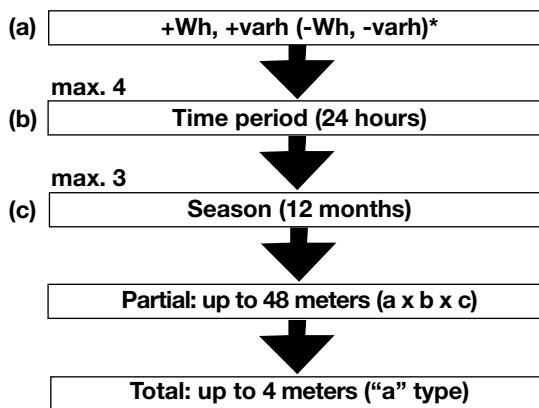
## Harmonic distortion analysis

<b>Analysis principle</b>	FFT	
<b>Harmonic measurement</b> Current Voltage	Up to the 50 <sup>th</sup> harmonic Up to the 50 <sup>th</sup> harmonic	
<b>Type of harmonics</b>	THD (VL1) THD odd (VL1) THD even (VL1) The same for the other phases: L2, L3. THD (AL1) THD odd (AL1) THD even (AL1) The same for the other phases: L2, L3.	
<b>Harmonic phase angle</b>	The instrument measures the angle between the single harmonic of "V" and the single harmonic of "I" of the same order. According to the value of the electrical angle, it is	<b>Harmonic details</b>
		possible to know if the distortion is absorbed or generated. Note: if the system has 3 wires the angle cannot be measured.
		The harmonic contents is displayed as a graph showing the whole harmonic spectrum. This value is also given as a numerical information: THD % / RMS value THD even % / RMS value THD odd% / RMS value single harmonics in % / RMS value
		<b>System</b>
		The harmonic distortion can be measured in single-phase, 3-wire or 4-wire systems. Tw: 0.02

## Time period management (energy, water and gas metering)

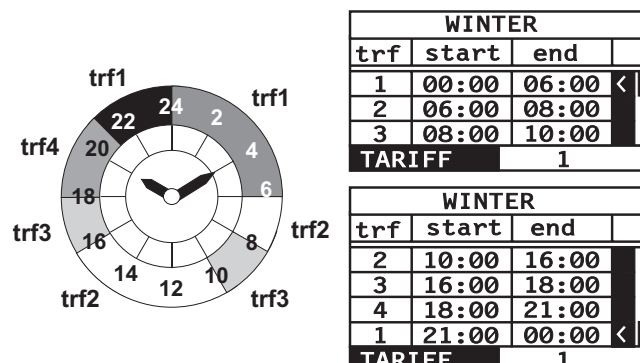
<b>Time periods</b>	Energy Selectable: single time, dual time and multi-time
<b>Single time</b> Number of meters	Energy, water, gas Total: 4 (9-digit) (no partial meters)
<b>Dual time</b> Number of meters  Time periods	Energy, gas Total: 4 (9-digit) Partial: 8 (6-digit); 2, programmable within 24 hours
<b>Multi-time</b> Number of meters  Time periods  Time seasons	Energy Total: 4 (9-digit) Partial: 48 (6-digit); 4, programmable within 24 hours 3, programmable within 12 months;
<b>Pulse output</b>	Connectable to total and/or partial meters (dual time, multi-time periods)
<b>Energy metering recording</b>	Energy consumption history, recording of energy metering by months, oldest data: 2 months before current date. Recording of total and partial energy metering. Energy metering recording (EEPROM) Max.999,999,999.99kWh/kvarh.

### Management concept (multi-time)



\* Only if measuring analogue inputs are present.

### Example of multi-time energy metering



## Display pages

### Display variables in three-phase systems, 4-wire connections

No	1st variable	2nd variable	3rd variable	4th variable	Note
0	Selectable	Selectable	Selectable	Selectable	
1	V L1	V L2	V L3	V L-N sys	Sys = system = Σ
2	V L1-2	V L2-3	V L3-1	V L-L sys	Sys = system = Σ
3	A L1	A L2	A L3	An	A n = neutral current
4	W L1	W L2	W L3	W sys	Sys = system = Σ
5	var L1	var L2	var L3	var sys	Sys = system = Σ
6	VA L1	VA L2	VA L3	VA sys	Sys = system = Σ
7	PF L1	PF L2	PF L3	PF sys	
8	V L1	A L1	PF L1	W L1	
9	V L2	A L2	PF L2	W L2	
10	V L3	A L3	PF L3	W L3	
11	V sys	PF sys	var sys	W sys	Sys = system = Σ
12	An	PF sys	Hz	W sys	Sys = system = Σ
13	W dmd	var dmd	PF avg	VA dmd	
14	(MAX1)	(MAX2)	(MAX3)	(MAX4)	The MAX value can be one of the above mentioned (From No 0 to No 13)
15	(MAX5)	(MAX6)	(MAX7)	(MAX8)	
16	(MAX9)	(MAX10)	(MAX11)	(MAX12)	
17	(MIN1)	(MIN2)	(MIN3)	(MIN4)	
18	(MIN5)	(MIN6)	(MIN7)	(MIN8)	The MIN value can be one of the above mentioned (From No 0 to No 13)
19	Histogram FFT V1 (THD, THDo, THDe, Single harmonic)				Only if analysis V1-A1 are activated
20	Histogram FFT A1 (THD, THDo, THDe, Single harmonic)				Only if analysis V1-A1 are activated
21	Histogram FFT V2 (THD, THDo, THDe, Single harmonic)				Only if analysis V2-A2 are activated
22	Histogram FFT A2 (THD, THDo, THDe, Single harmonic)				Only if analysis V2-A2 are activated
23	Histogram FFT V3 (THD, THDo, THDe, Single harmonic)				Only if analysis V3-A3 are activated
24	Histogram FFT A3 (THD, THDo, THDe, Single harmonic)				Only if analysis V3-A3 are activated
25	kWh + TOT	kWh - TOT	kvarh + TOT	kvarh - TOT	
26	kWh+	kWh-	kvarh+	kvarh-	Partial energy being measured
27	GAS m <sup>3</sup>	WATER m <sup>3</sup> or GAS m <sup>3</sup> night tariff			According to the setting

#### Used calculation formulas

##### Phase variables

Instantaneous effective voltage

$$V_{IN} = \sqrt{\frac{1}{n} \cdot \sum_{i=1}^n (V_{1n})^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_{i=1}^n (V_{1n}) \cdot (A_1)_i$$

Instantaneous power factor

$$\cos\phi_1 = \frac{W_1}{VA_1} \quad (\text{TPF})$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_{i=1}^n (A_1)_i^2}$$

Instantaneous apparent power

$$VA_1 = V_{IN} \cdot A_1$$

Instantaneous reactive power

$$VAR_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

#### System variables

Equivalent three-phase voltage

$$V_{\Sigma} = \frac{V_{12} + V_{23} + V_{31}}{3}$$

Three-phase reactive power

$$VAR_{\Sigma} = (VAR_1 + VAR_2 + VAR_3)$$

Neutral current

$$An = \overline{A_{L1}} + \overline{A_{L2}} + \overline{A_{L3}}$$

Three-phase active power

$$W_{\Sigma} = W_1 + W_2 + W_3$$

Three-phase apparent power

$$VA_{\Sigma} = \sqrt{W_{\Sigma}^2 + VAR_{\Sigma}^2}$$

Three-phase power factor

$$\cos\phi_{\Sigma} = \frac{W_{\Sigma}}{VA_{\Sigma}} \quad (\text{TPF})$$

Total harmonic distortion

$$THD_i = \frac{\sqrt{\sum_{h=2}^n T_{h,i}^2}}{T_{1,i}}$$

Where:

i = considered phase (L1, L2 or L3)

T = considered variable (V or A)

n = harmonic order

#### Energy metering

$$kWh_i = \int_{t_1}^{t_2} P_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} P_{o,i}$$

$$kVarh_i = \int_{t_1}^{t_2} Q_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} Q_{o,i}$$

Where:

i = considered phase (L1, L2 or L3)

P = active power

Q = reactive power

t<sub>1</sub>, t<sub>2</sub> = starting and ending time points of consumption recording

n = time unit

Δt = time interval between two successive power consumptions

n<sub>1</sub>, n<sub>2</sub> = starting and ending discrete time points of consumption recording



## List of the variables that can be connected to:

- Max./Min. variable detection
- Alarm outputs
- Pulse outputs

No	Variable	1-phase system	3-ph. 4-wire balanced sys.	3-ph. 4-wire unbal. sys.	3 ph. 3-wire bal. sys.	3 ph. 3-wire unbal. sys.	meas. module not available	Notes
1	V L1	o	x	x	o	o	o	
2	V L2	o	x	x	o	o	o	
3	V L3	o	x	x	o	o	o	
4	V L-N sys	o	x	x	o	o	o	Σ Sys = system = Σ
5	V L1-2	o	x	x	x	x	o	
6	V L2-3	o	x	x	x	x	o	
7	V L3-1	o	x	x	x	x	o	
8	V L-L sys	o	x	x	x	x	o	Σ Sys = system = Σ
9	A L1	x	x	x	x	x	o	
10	A L2	o	x	x	x	x	o	
11	A L3	o	x	x	x	x	o	
12	An	o	x	x	x	x	o	
13	W L1	x	x	x	o	o	o	
14	W L2	o	x	x	o	o	o	
15	W L3	o	x	x	o	o	o	
16	W sys	o	x	x	x	x	o	Σ Sys = system = Σ
17	var L1	x	x	x	o	o	o	
18	var L2	o	x	x	o	o	o	
19	var L3	o	x	x	o	o	o	
20	var sys	o	x	x	x	x	o	Σ Sys = system = Σ
21	VA L1	x	x	x	o	o	o	
22	VA L2	o	x	x	o	o	o	
23	VA L3	o	x	x	o	o	o	
24	VA sys	o	x	x	x	x	o	Σ Sys = system = Σ
25	PF L1	x	x	x	o	o	o	
26	PF L2	o	x	x	o	o	o	
27	PF L3	o	x	x	o	o	o	
28	PF sys	o	x	x	x	x	o	Σ Sys = system = Σ
29	Hz	x	x	x	x	x	o	
30	THD V1	x	x	x	x	x	o	FFT V1-A1 ON
31	THDo V1	x	x	x	x	x	o	FFT V1-A1 ON
32	THDe V1	x	x	x	x	x	o	FFT V1-A1 ON
33	THD V2	o	x	x	x	x	o	FFT V2-A2 ON
34	THDo V2	o	x	x	x	x	o	FFT V2-A2 ON
35	THDe V2	o	x	x	x	x	o	FFT V2-A2 ON
36	THD V3	o	x	x	x	x	o	FFT V3-A3 ON
37	THDo V3	o	x	x	x	x	o	FFT V3-A3 ON
38	THDe V3	o	x	x	x	x	o	FFT V3-A3 ON
39	THD A1	x	x	x	x	x	o	FFT V1-A1 ON
40	THDo A1	x	x	x	x	x	o	FFT V1-A1 ON
41	THDe A1	x	x	x	x	x	o	FFT V1-A1 ON
42	THD A2	o	x	x	x	x	o	FFT V2-A2 ON
43	THDo A2	o	x	x	x	x	o	FFT V2-A2 ON
44	THDe A2	o	x	x	x	x	o	FFT V2-A2 ON
45	THD A3	o	x	x	x	x	o	FFT V3-A3 ON
46	THDo A3	o	x	x	x	x	o	FFT V3-A3 ON
47	THDe A3	o	x	x	x	x	o	FFT V3-A3 ON
48	A dmd	x	x	x	x	x	o	
49	VA dmd	x	x	x	x	x	x	
50	PF avg	x	x	x	x	x	x	
51	W dmd	x	x	x	x	x	x	◆
52	ASY	o	x	x	x	x	o	

(x) = available (o) = not available

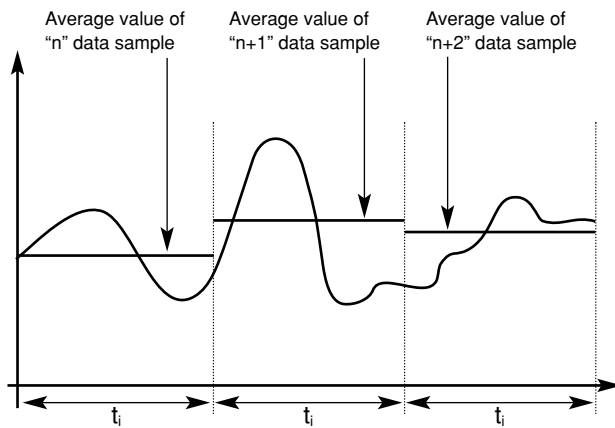
◆ Notes: the alarm outputs can be connected to Wdmd total and/or Wdmd tariff1, Wdmd tariff2, Wdmd tariff3, Wdmd tariff4.



## Historical data storing time table

Average values only Time interval (minutes)	2 Selected variables			4 Selected variables			6 Selected variables			8 Selected variables		
	Data storing time			Data storing time			Data storing time			Data storing time		
	DAYS	WEEK	YEARS	DAYS	WEEK	YEARS	DAYS	WEEK	YEARS	DAYS	WEEK	YEARS
1	122	17	-	81	12	-	61	9	-	49	7	-
5	610	87	1.7	407	58	1.1	305	44	-	244	35	-
10	-	174	3.4	814	116	2.2	610	87	1.7	488	70	1.3
15	-	262	5.0	-	174	3.4	915	131	2.5	732	105	2
20	-	349	6.7	-	232	4.5	-	174	3.4	976	139	2.7
25	-	436	8.4	-	291	5.6	-	218	4.2	-	174	3.4
30	-	523	10.1	-	349	6.7	-	262	5	-	209	4
35	-	610	11.7	-	407	7.8	-	305	5.9	-	244	4.7
40	-	697	13.4	-	465	8.9	-	349	6.7	-	279	5.4
45	-	785	15.1	-	523	10.1	-	392	7.5	-	314	6
50	-	872	16.8	-	581	11.2	-	436	8.4	-	349	6.7
55	-	959	18.4	-	639	12.3	-	479	9.2	-	384	7.4
60	-	-	20.1	-	697	13.4	-	523	10.1	-	418	8

### The working mode of data logging



$t_i$  = time interval (programmable from 1 to 60 minutes)

### The Wm4Soft network potential

Download data files from WM4-96 to PC

Type of Network	No. of Network	No. of WM4	Port	Local Accessory	PC Accessory	User	◆
Local	1	1	AR1041 (RS232)	None	None	PC	A
Local	1	10	AR1041 AR1034	None	SIU-PC	PC	B
Remote	100	1	AR1041 (RS232)	Analogue modem	Analogue modem	PC	A
Remote	100	1	AR1041 (RS232)	GSM modem	Analogue modem	PC	C
Remote	100	10	AR1041 AR1034 (RS485)	SIU-PC+ analogue modem	Analogue modem	PC	B
Remote	100	10	AR1041 AR1034 (RS485)	SIU-PC+ GSM modem	Analogue modem	PC	B

◆ **Notes:**

- A- Only data download
- B- Data download. Each AR1041 can be connected to a GSM modem in order to manage the SMS messages.
- C- The WM4-96 can be set to manage the data download or to manage SMS messages.



## The available modules

Type	N. of channels	Order code
WM4-96 base		AD1040
AV5.3 measuring inputs		AQ1018
AV7.3 measuring inputs		AQ1019
18-60VAC/DC power supply		AP1021
90-260VAC/DC power supply		AP1020
RS485 port (1)	1	AR1034
Relay output (*)	1	AO1058
Relay output (*)	2	AO1035
Open collector output (*)	1	AO1059
Open collector output (*)	2	AO1036
Open collector output (*)	4	AO1037
Digital inputs	3	AQ1038
Digital inputs + Aux	3	AQ1042
RS232 port + RTC + 2Mb Data memory (1)	1	AR1041

## The possible module combinations

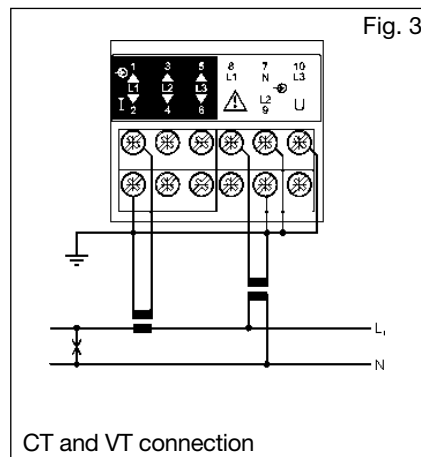
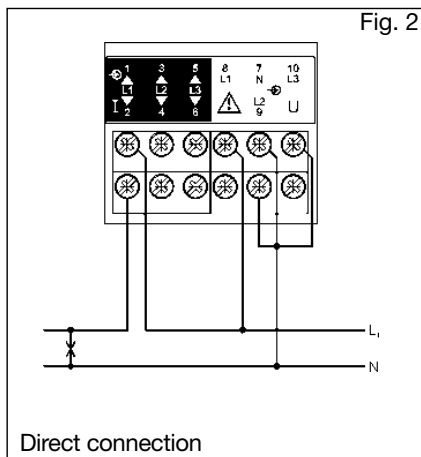
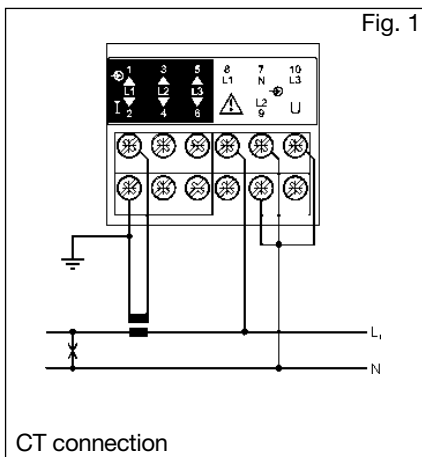
Basic unit	Slot A	Slot B	Slot C	Slot D
RS485 port		●		
Single relay output (*)			●	●
Single open collect. output (*)			●	●
Dual relay output (*)			●	●
Dual open coll. output (*)			●	●
4 open coll. output (*)				●
3 digital inputs			●	
3 digital inputs + Aux	●		●	
Basic unit	Slot E			
RS232 port + RTC + 2Mb Data memory		●		

(\*) Alarm or pulse

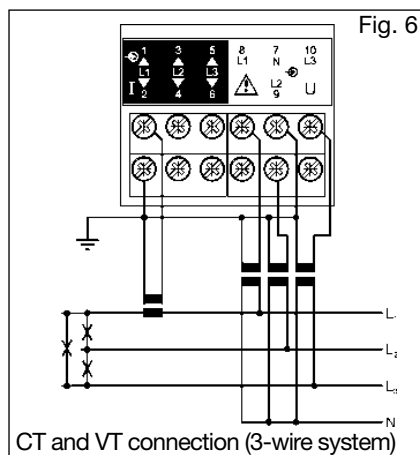
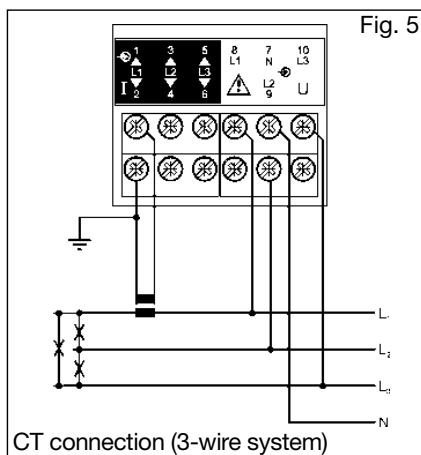
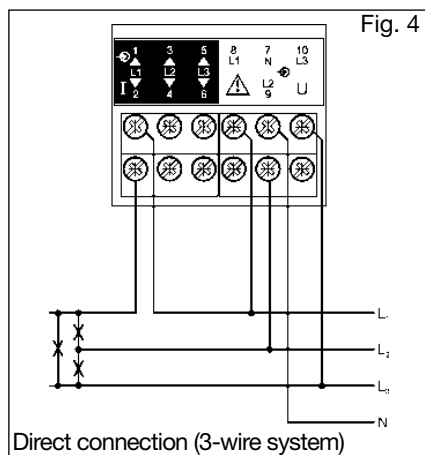
(1) The RS232 module works as alternative of the RS485 module.

## Wiring diagrams

### Single phase input connections

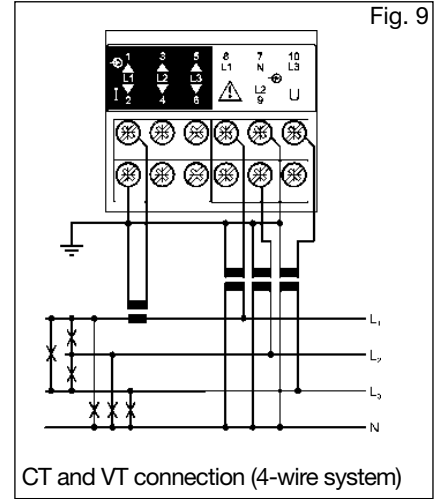
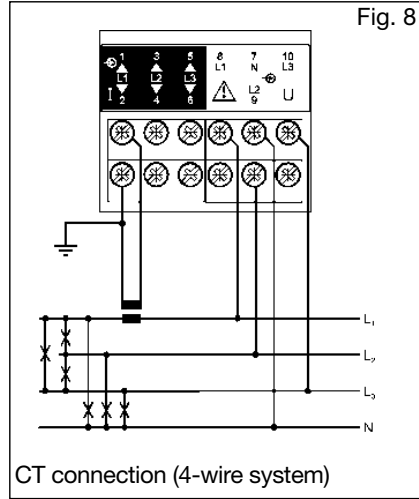
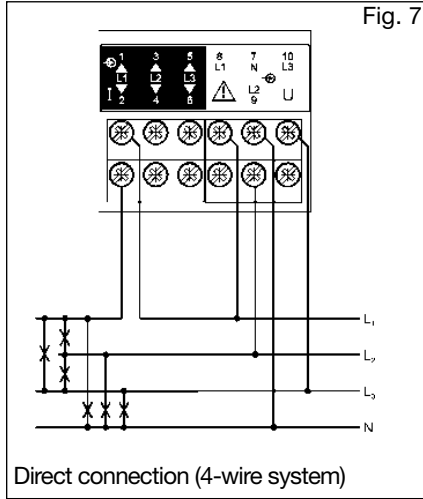


### Three-phase three-wire input connections - Balanced load

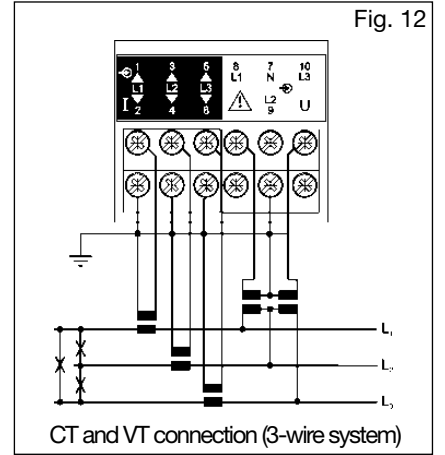
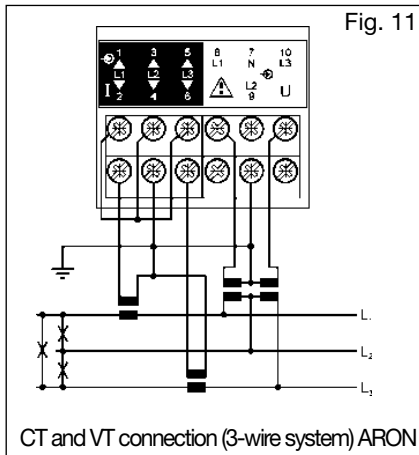
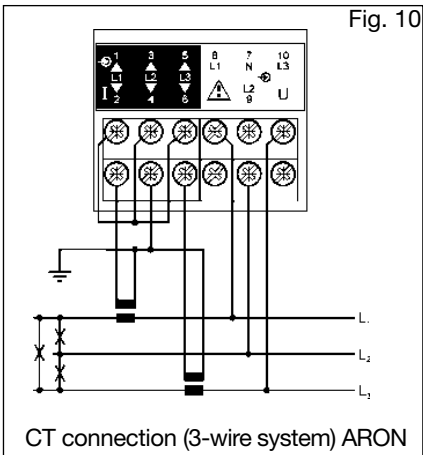


## Wiring diagrams (cont.)

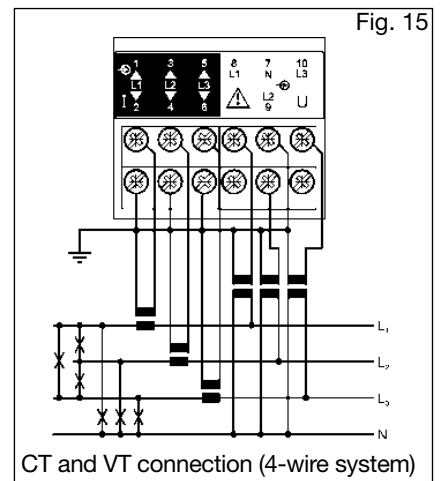
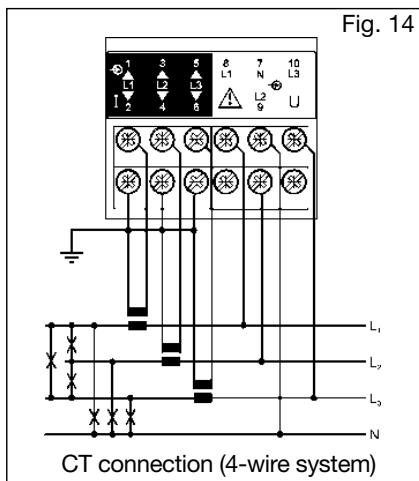
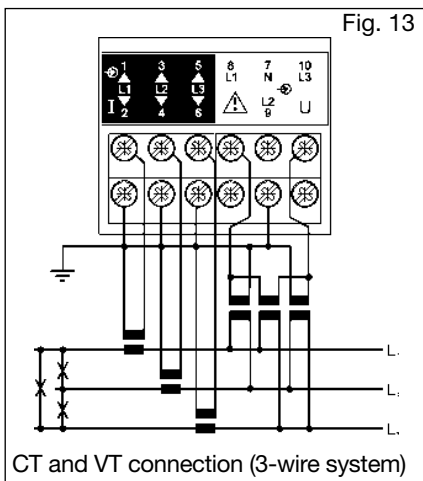
### Three-phase, four-wire input connections - Balanced load



### Three-phase, three-wire input connections - Unbalanced load

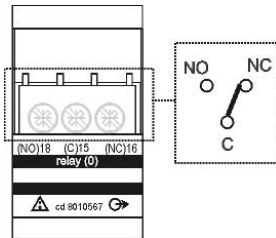
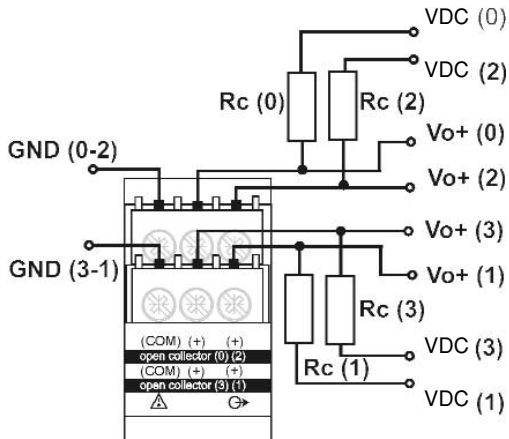


### Three-phase, three and four wires input connections - Unbalanced load

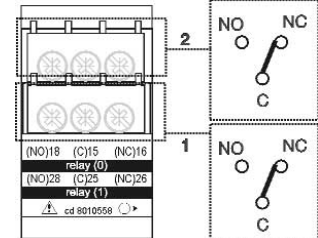




## Wiring diagrams of optional modules

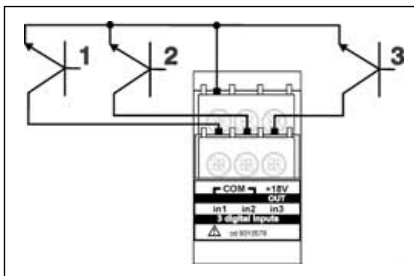


AO1058 1 relay output



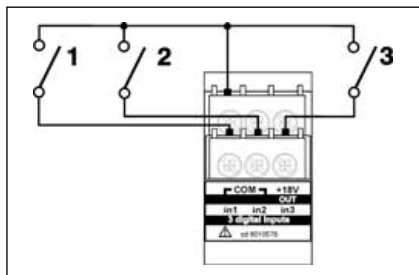
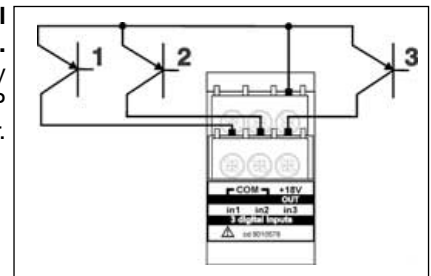
AO1035 2 relay outputs

**AO1037 4 open collector outputs:** The load resistance ( $R_c$ ) must be designed so that the closed contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30V.  
 VDC: power supply voltage output. Vo+: positive output contact (open collector transistor). GND: ground output contact (open collector transistor).



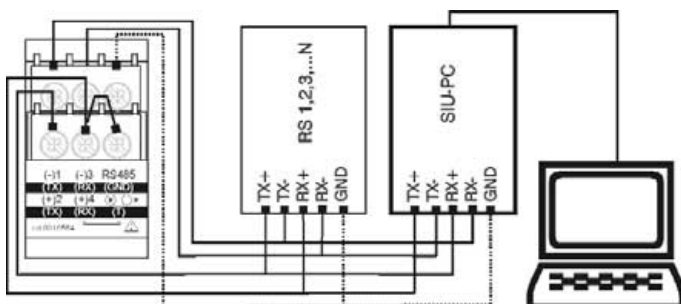
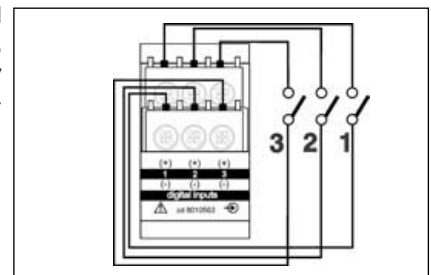
**AQ1042 digital input module.** Connection by means of NPN transistor.

**AQ1042 digital input module.** Connection by means of PNP transistor.



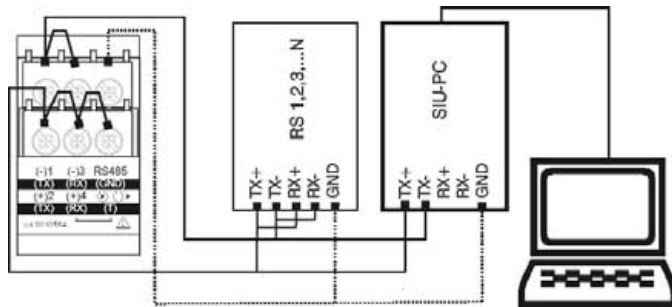
**AQ1042 digital input module.** Connection by means of contacts.

**AQ1038 digital input module.** Connection by means of contacts.



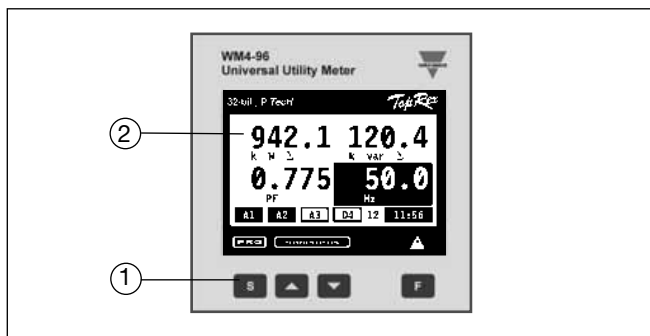
**AR1034 RS422/485 4-wires connection:** additional devices provided with RS422/485 (that is RS 1, 2, 3...N) are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T).

## Wiring diagrams optional modules, cont.



**AR1034 RS422/485 2-wires connection:** additional devices provided with RS422/485 (that is RS 1, 2, 3...N) are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T).

## Front panel description



- ▲ and ▼
- to program values
- to select functions
- to scroll display pages
- [F] for special functions

### 2. Display

- Istantaneous measurements:
  - 4 digits (max display 9999)
- Energies, gas, water:
  - 9 digits (max display 999999999).

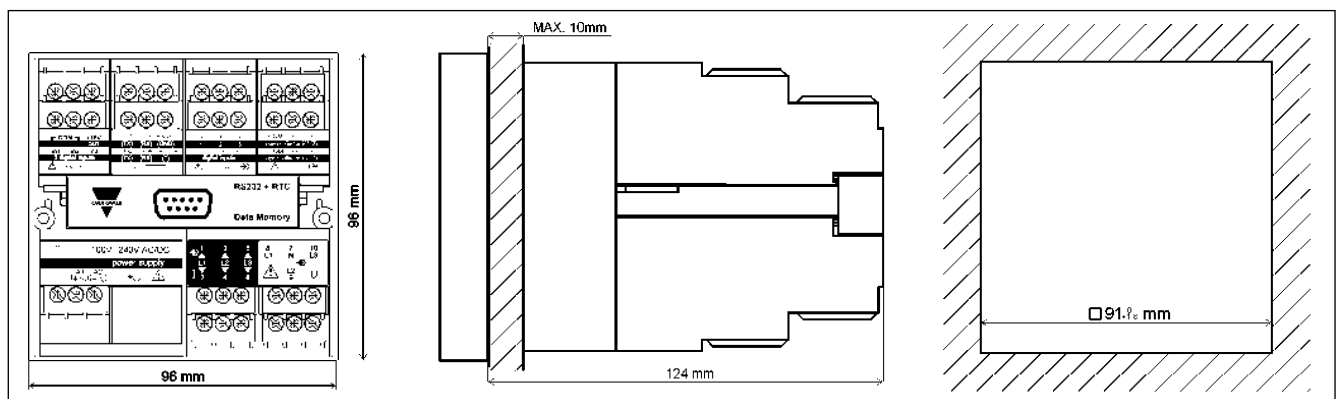
### 1. Key-pad

Set-up, programming and display parameters are easily controlled by the 4 push-buttons.

- [S] to enter programming and to confirm password.

- Alphanumeric indications by means of LCD display for:
  - Display of configuration parameters
  - All measuring variables.

## Dimensions

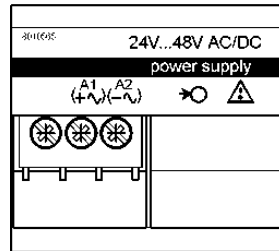


# Modules

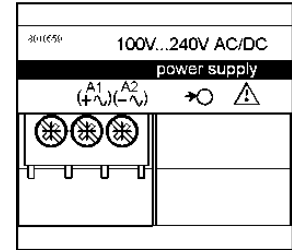
## Power supply modules



**AR1041**  
RS232 Interface + RTC+ 2Mb  
Data memory

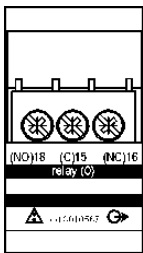


**AP1021**  
Power supply 18-60VAC/DC

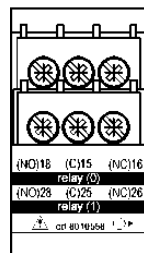


**AP1020**  
Power supply 90-260 VAC/DC

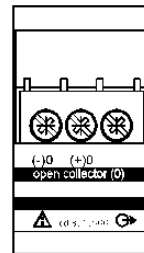
## Digital output modules



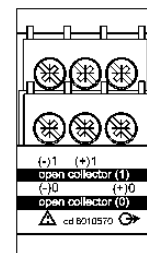
**AO1058**  
Single relay output



**AO1035**  
Dual relay output

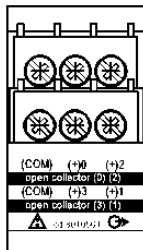


**AO1059**  
Single open  
collector output



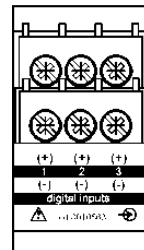
**AO1036**  
Dual open  
collector output

## Digital output modules

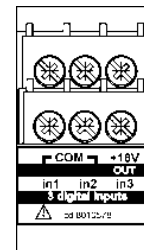


**AO1037**  
4 open collector  
outputs

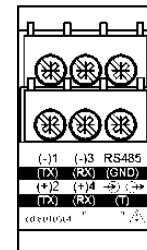
## Other input/output modules



**AQ1038**  
3 digital inputs



**AQ1042**  
3 digital inputs + aux



**AR1034**  
RS485 port